United States Patent [19]

Harwood et al.

[11] **4,065,886**

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[54] **PORTABLE ABRASION TOOL**

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[51] **Int. Cl.**[2] **B24B 41/00**

[52] **U.S. Cl.** ..... **51/166 FB;** 51/268

[58] **Field of Search** ..... 51/166 TS, 166 FB, 268, 51/270, 98 R; 144/35 A, 1 C

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[57] **ABSTRACT**

A portable apparatus for reducing the dimensions of a workpiece by abrading means. The apparatus comprises in combination: a portable electric drill motor having a tool shaft-receiving chuck; a workpiece abrading means operatively connected with a shaft adapted to be engaged by the chuck; a guide member supporting the drill motor; a base member adapted to receive and support (1) the guide member adjacent one end, and (2) a housing generally surrounding the abrading means adjacent the other end; the base member having retentive parallel positioning rails extending longitudinally along each lateral edge of a face of the base member; the guide member being slidable longitudinally of the base member whereby the drill motor is adjustably advanceable toward the end of the base member to allow the tool to be aligned with the housing or guard.

20 Claims, 11 Drawing Figures

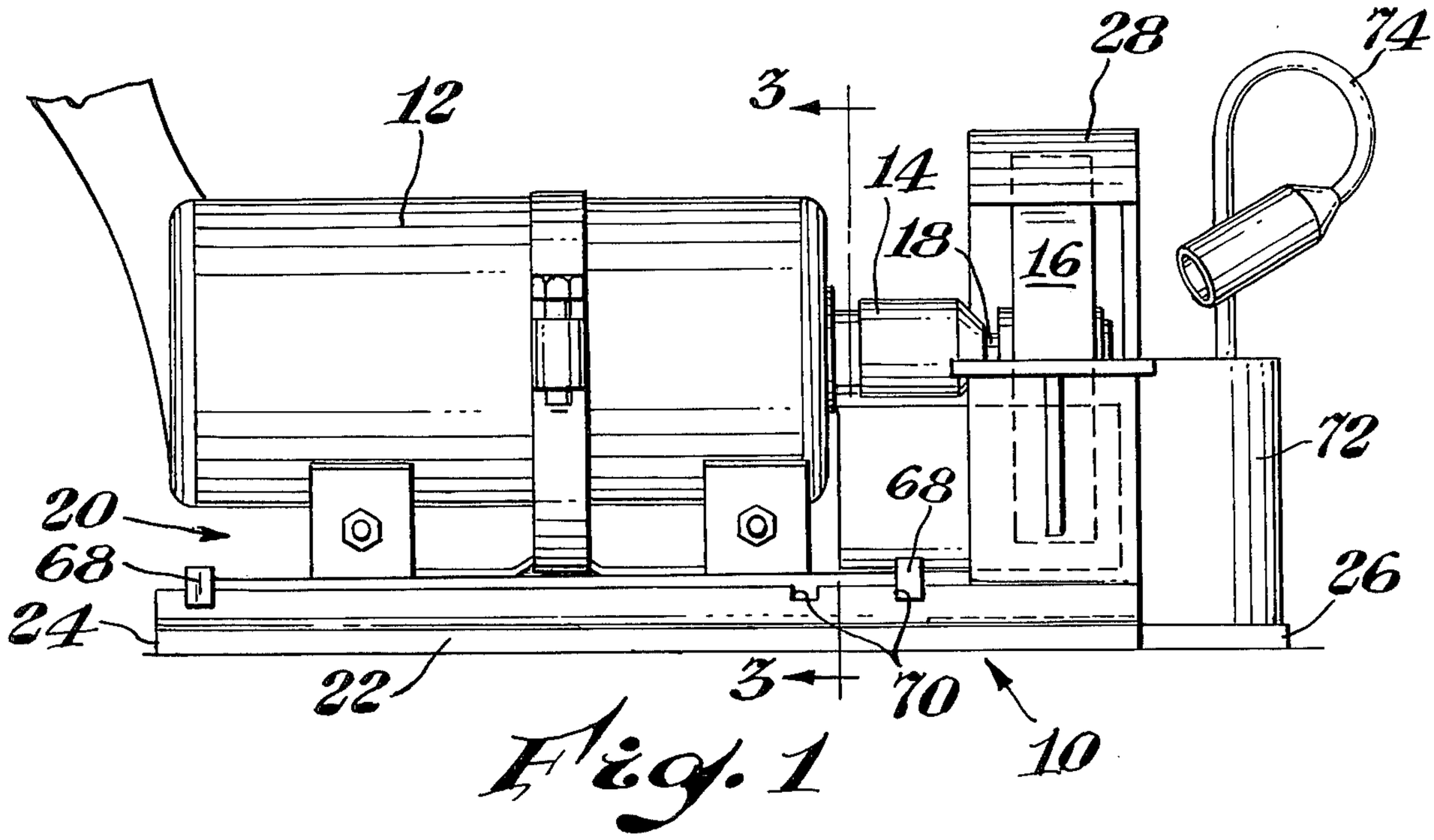

Fig. 1

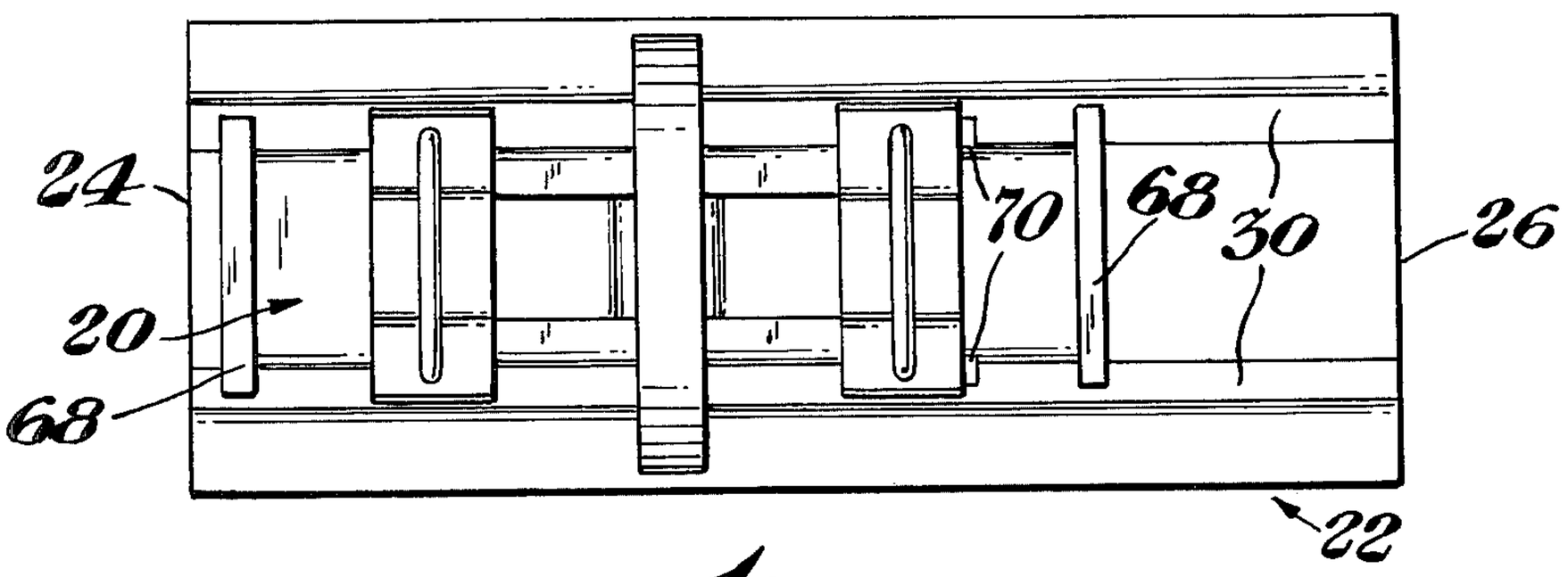

Fig. 2

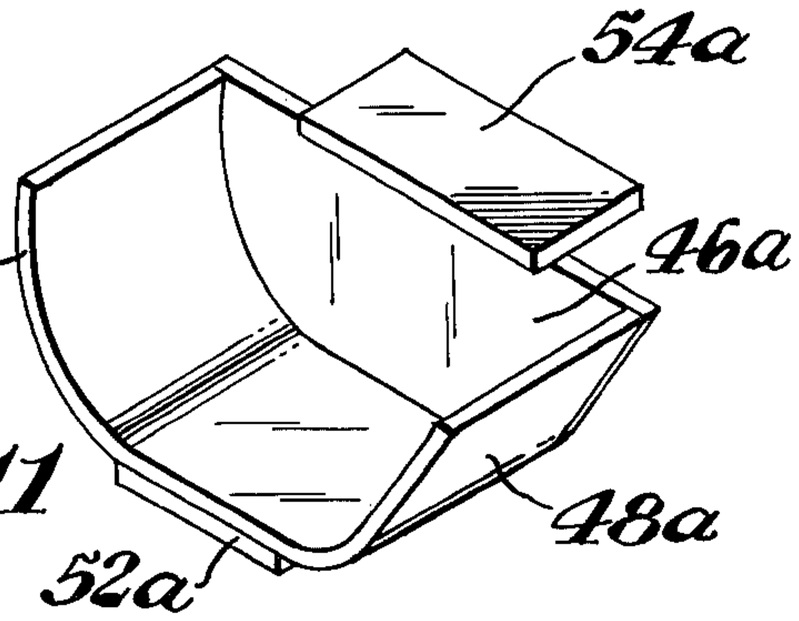

Fig. 11

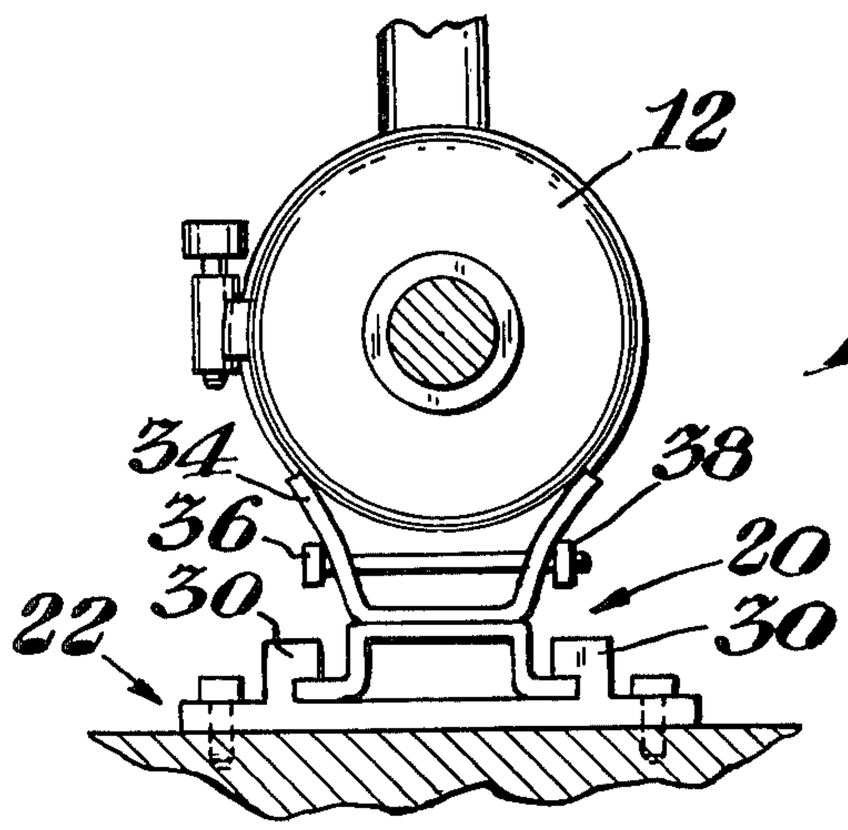

Fig. 3

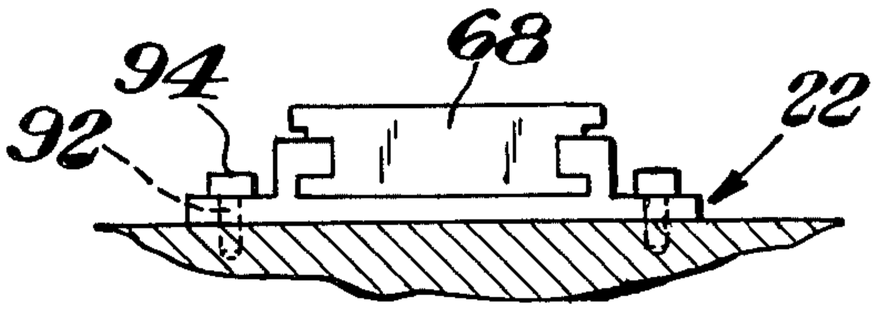

Fig. 4

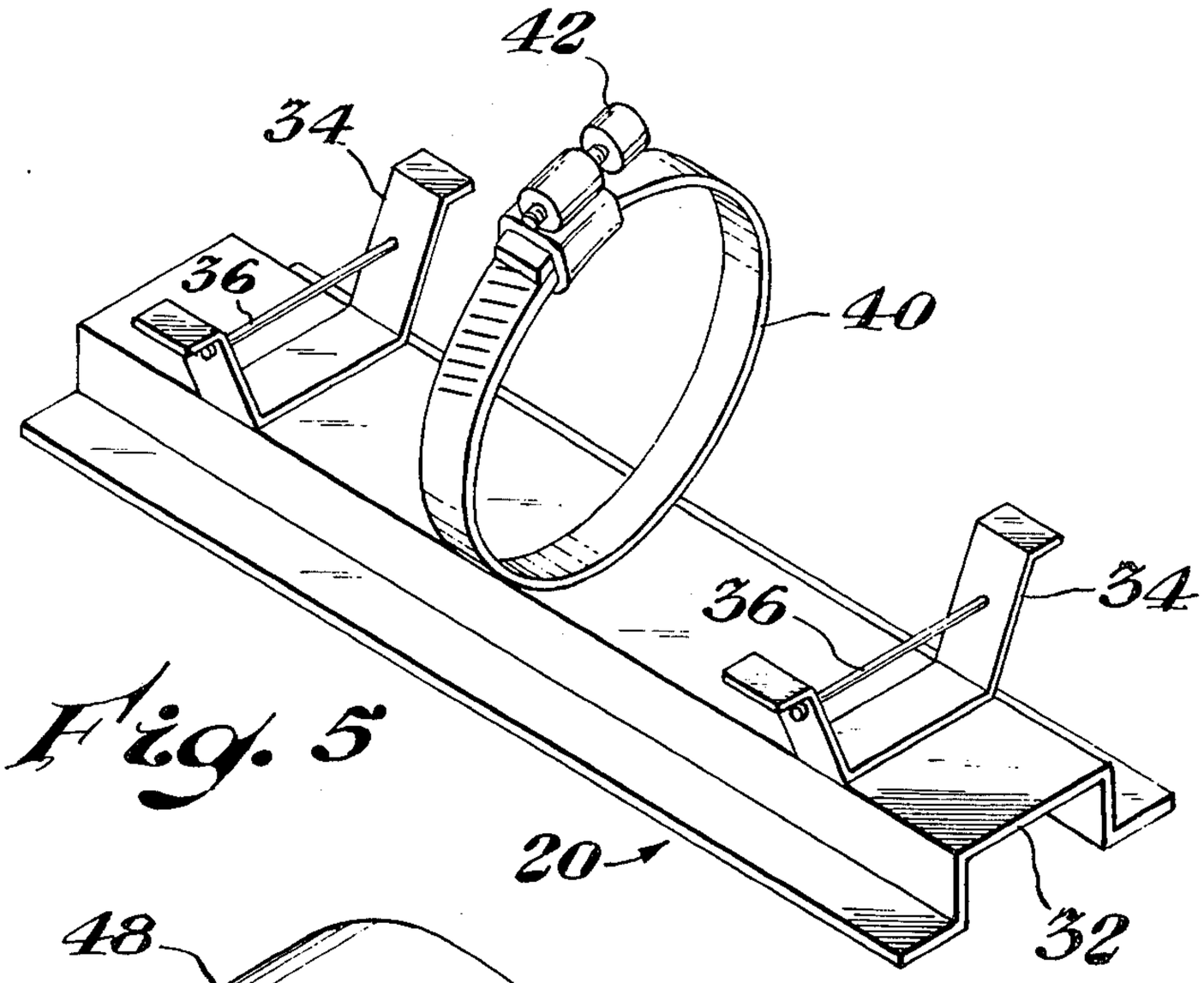

Fig. 5

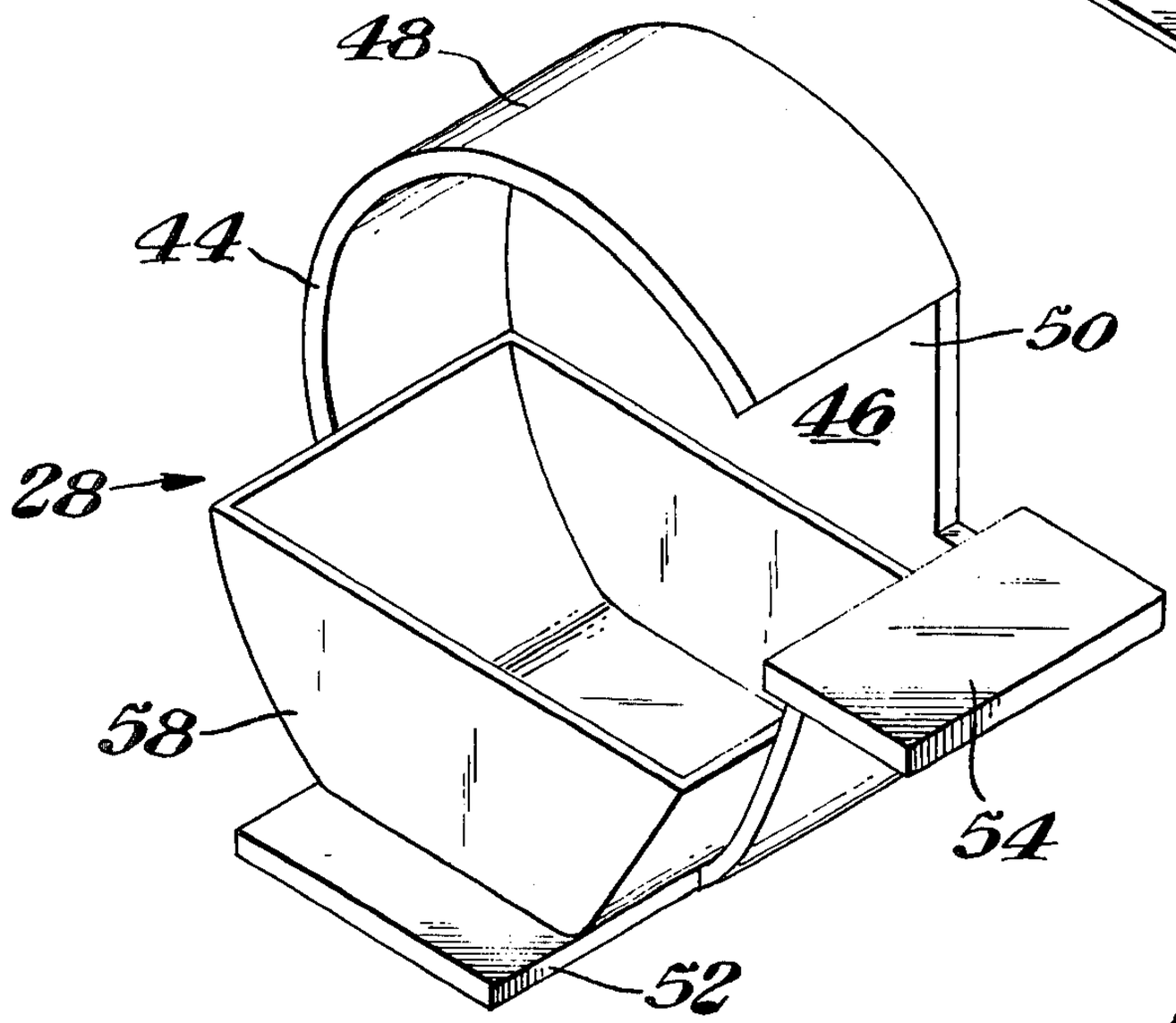

Fig. 7

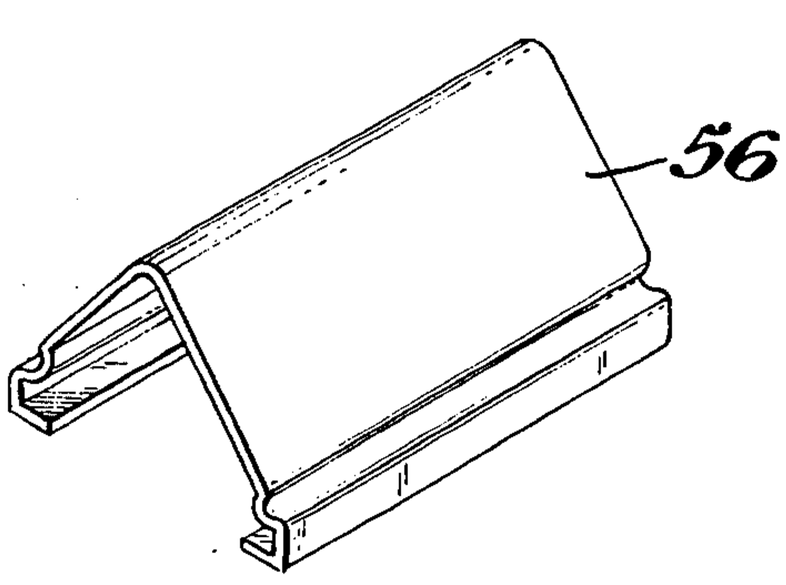

Fig. 8

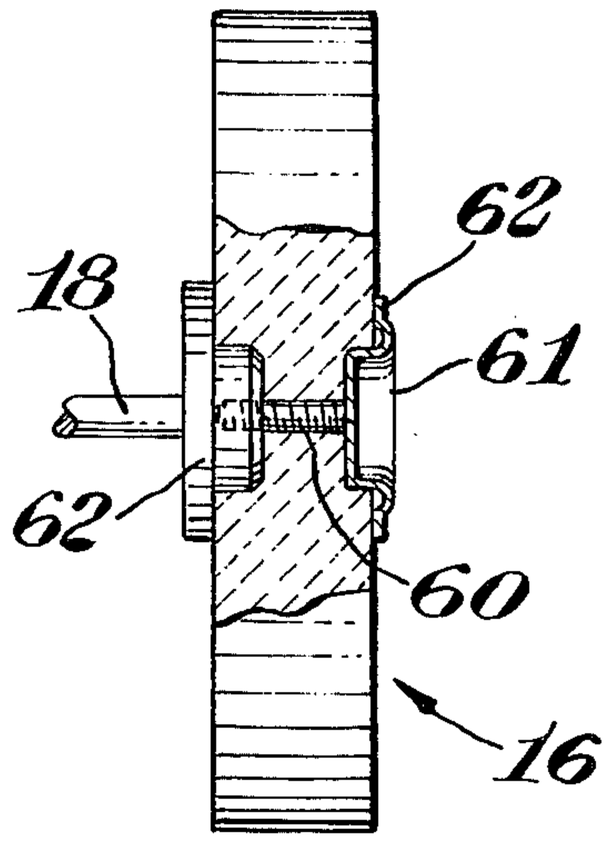

Fig. 6

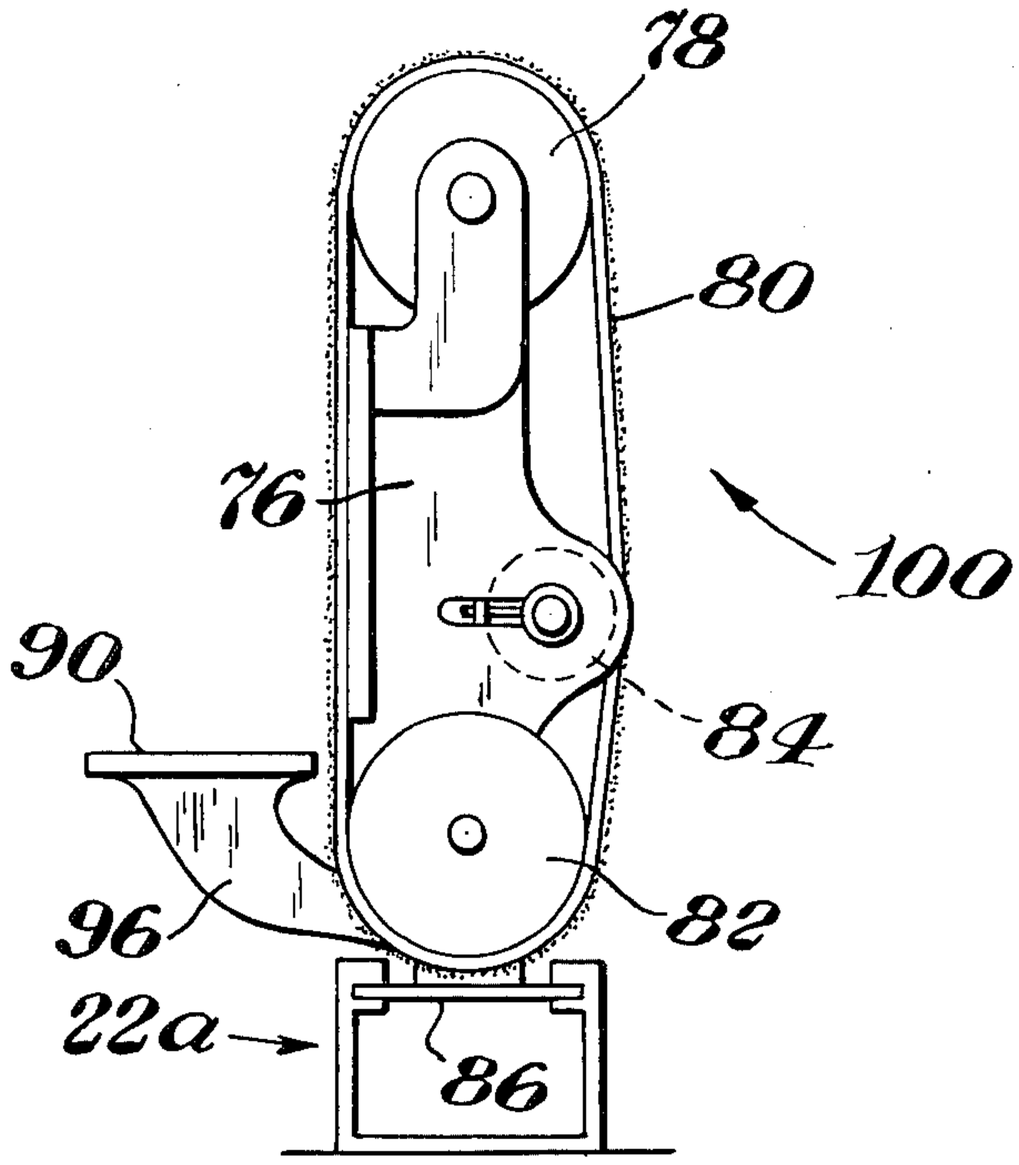

Fig. 9

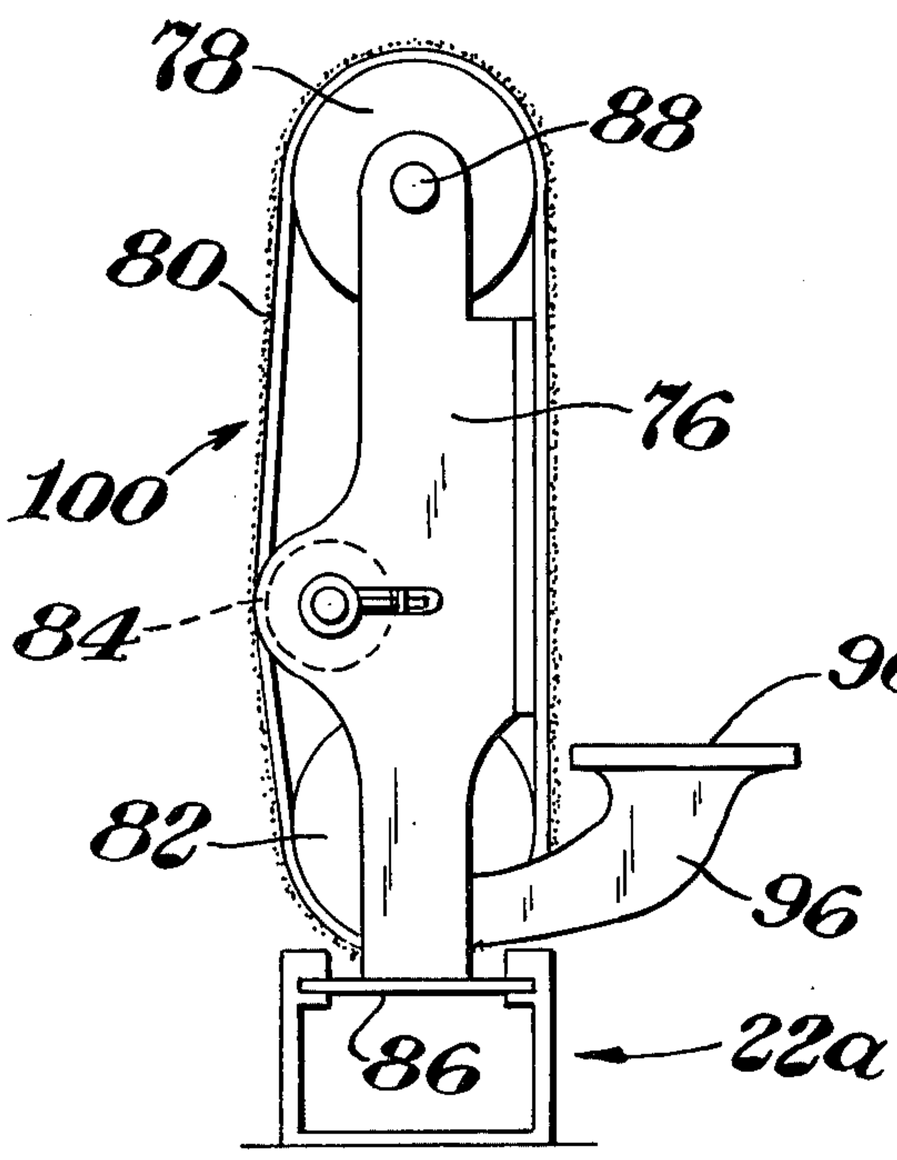

Fig. 10

PORTABLE ABRASION TOOL

BACKGROUND AND FIELD OF THE INVENTION

The present invention relates generally to a portable apparatus, and more in particular to a portable apparatus for reducing the dimensions of a workpiece by abrading means utilizing a portable electric drill motor as the drive means. Such drill motors include both battery driven and line driven motors.

Numerous motor driven tools are found in the prior art which are capable of reducing the dimensions of a workpiece by abrading means. These include grinding wheels, honing wheels, belt sanders, disc sanders, wire brush wheels, buffing wheels and the like. Generally each of these devices is either incorporated into a rather sturdy apparatus which is too heavy to be readily moveable from place to place or if portable, is not designed to be accurate, reliable, safe and durable. Furthermore, so far as is known, the abrasive means or tool head of the various prior art devices are not normally capable of being interchangeably driven by a single power unit such as a portable electric drill motor. This often requires the craftsman to acquire separately powered devices for each grinding, honing or sanding operation.

It is, therefore, desirable to provide a single portable apparatus for reducing the dimensions of a workpiece which apparatus includes an electric drill motor, rotatable abrading means, and a jig for adjustably positioning the electric drill motor and the abrading means in operative relationship, the abrading means including grinding, honing and belt or disc sanding devices or tool heads, the entire apparatus being not only portable but accurate, reliable, safe and durable, while being relatively inexpensive to construct and maintain.

SUMMARY OF THE INVENTION

The apparatus of the present invention is a portable apparatus for reducing the dimensions of a workpiece by abrading means. In basic essence, the apparatus comprises: a portable electric drill motor; rotatable workpiece abrading means; a housing generally surrounding at least a portion of said abrading means; a jig for adjustably positioning the electric drill motor and the housing in operative relationship, said workpiece abrading means being readily replaceable by alternative preselected rotatable workpiece abrading means; said jig having a channelled base member and a guide member slidably engaging said base member for supporting and moving said electric drill motor. For purposes of the specification and claims, rotatable workpiece abrading means include grinding wheels, honing wheels, disc sanders, wire brush wheels, buffing wheels and a belt sander wherein a driven roll is supportable in a tool shaft-receiving chuck of an electric drill motor. In a preferred form, the apparatus comprises in combination: a portable electric drill motor having a tool shaft-receiving chuck; a rotatable workpiece abrading means operatively connected with a shaft adapted to be engaged by said chuck; a guide member having supported thereon said drill motor; a base member having a first end and a second end and adapted to receive and support (1) adjacent the first end thereof said guide member and (2) adjacent the second end thereof a housing adapted to generally surround at least a portion of said abrading means; said base member having retentive substantially parallel positioning rails extending longitudinally along each lateral edge of a face of said base member; said guide member being slidable longitudinally of said base member whereby the drill motor mounted thereon is adjustably positionable with respect to the second end of said base member whereby a tool with its shaft engaged in the chuck of the drill motor is suitably aligned with a guard or housing placed on or affixed to said second end of the base member; said base member being substantially coextensive with the combination of said guide member and said housing.

If desired a liquid reservoir adapated to be removably nested in the housing can be provided to receive a lower portion of the workpiece abrading means as for honing. In another preferred form of the present apparatus a battery-operated light assembly having the bottom portion of the housing for the battery adapted to be positioned on or to engage the positioning rails of the base member is provided adjacent the housing, ordinarily on the side of the housing remote from the guide member.

SUMMARY DESCRIPTION OF THE DRAWINGS

FIG. **1** is a view in side elevation of an embodiment of the apparatus in accordance with the present invention.

FIG. **2** is a plan view of the apparatus of FIG. **1** showing only the guide member supported on the base member with the drill motor omitted for clarity.

FIG. **3** is an end view in section of the apparatus taken along line **3—3** of FIG. **1**.

FIG. **4** is an end view in section of the apparatus taken along line **3—3** of FIG. **1** showing only locking means engaged in the base member.

FIG. **5** is a view in isometric projection of the guide member for the drill motor shown in FIG. **1**.

FIG. **6** is a view in side elevation, partly broken away and in section, of the workpiece abrading means shown in FIG. **1**.

FIG. **7** is a view in isometric projection of the housing shown in FIG. **1**.

FIG. **8** is a view in isometric projection of a workpiece supporting clip adapted to be attached to the housing shown in FIG. **7**.

FIG. **9** is a side view of another embodiment of the housing of the present invention shown surrounding a belt sander abrading means.

FIG. **10** is a side view of the housing of FIG. **9** as viewed from the opposite side.

FIG. **11** is a reduced view in isometric porjection of another embodiment of the housing of the present invention.

PARTICULARIZED DESCRIPTION OF THE INVENTION

Referring now to the embodiment illustrated in FIGS. **1**, **2** and **3**, there is depicted an apparatus in accordance with the present invention designated generally by the reference numeral **10**. The apparatus **10** is seen to include a portable electric drill motor **12** having a tool shaft-receiving chuck **14**; a workpiece abrading head **16** mounted upon a shaft **18** engaged by the tool shaft-receiving chuck **14**; a guide member indicated generally by the numeral **20** having supported thereon the portable electric drill motor **12**; and a planar, elongated rectangular base or channel member **22**, having a first end **24** and a second end **26**. The base member **22** supports the guide member **20** adjacent the first end **24** thereof and supports adjacent the second end **26** thereof a guard or housing **28** which is adapted to partially or substantially surround the workpiece abrading head **16**.

The base member **22** has retentive parallel positioning rails **30** extending longitudinally along each lateral edge of a face of the base member **22**. The guide member **20** when released is slidable longitudinally of the base member **22** and the portable electric drill motor **12** as supported in the guide member **20** is adjustably advanceable upon moving the guide member **20** toward the second end **26** of base member **22**. To give proper support to the apparatus, the base member **22** must be substantially coextensive with the combination of the guide member **20** and the housing **28**.

Referring now particularly to FIGS. **3** and **5**, the guide member **20** is seen to include an elongated support member **32** having generally an inverted "U" shape section with the longitudinal edges terminating in outwardly extending flanges, the outwardly extending flanges being adapted to slide between the positioning rails **30** and to be retained by the inwardly extending longitudinal flange portion of such rails which form a part of the base member **22**, as shown in FIG. **3**. Two spaced-apart U-shaped support brackets **34** are attached closed sides back-to-back to the support member **32** adjacent each end of the support member **32**. The support brackets **34** are adapted to cradle and support the portable electric drill motor **12**. Compression means extend through each of the U-shaped support brackets **34** for selectively adjusting the spatial separation between upstanding arms of the U-shaped support brackets **34**. Suitable compression means include a threaded fastening element such as bolt **36** extending through the face of each U-shaped support bracket **34** and secured by an element such as nut **38** threaded thereon. Any suitable compression and fastening means can be used in place of the bolt **36** and nut **38** provided that the compression produced thereby against the lateral faces of support brackets **34** will cause the spatial separation of the upstanding arms of the U-shaped support brackets **34** to be reduced or, if loosened, to expand to adapt to the curvature and dimensions of a wide variety of commercially available portable electric drill motors **12**. The selective adjustability of the respective U-shaped brackets **34** of guide member **20** also affords and permits a leveling of the portable electric drill motor **12** so that the axis of the drill motor extends along a line substantially parallel to the plane of the guide member **20** and consequently also base member **22**.

The guide member assembly **20** also includes fastening means attached to the support member **32** as by tack welding or riveting for firmly securing the portable electric drill motor **12** to the guide member **20** so that the drill does not move normal to its axis when it is in operation. The electric drill motor **12** may be fastened to the guide member **20** in most any way that holds the drill firmly so that it does not oscillate. However, the fastening means is conveniently and preferably a hose clamp **40**, located at about mid-length of the guide member **20**. Preferably, the hose clamp **40** is provided with an adjustable, threadable closure means **42** adaptable to receive various sizes and shapes of electric drill motors.

As is evident from FIG. **2**, the guide member **20** is considerably shorter than the base member **22** so that a certain amount of movement is afforded the guide member **20** when it is slibably engaged in the base member **22**. In nearly all applications it is desirable to have the guide member **20** remain at a predetermined position along the base member **22** during use. While the slidable engagement may be sufficient in some cases, it is preferred to assuredly fix the guide member **20**. Accordingly, in one embodiment, the retentive parallel positioning rails **30** are notched as shown in FIGS. **1** and **2** to provide a plurality of pairs of horizontally aligned indexing slits **70** each pair being spaced apart the length of the guide member **20**. The various pairs of indexing slits **70** are spaced along the parallel positioning rails **30** at positions corresponding to predetermined spacing needs between the guide member **20** and the housing **28**, which spacing can vary depending on the abrading means employed, e.g., as determined by the length of drive shaft **18** to be engaged in the chuck **14** or the drill motor **12**. A movable stopping means, such as frame key **68**, drops into and is slidably held in one pair of the horizontally aligned indexing slits **70** at each end of the guide member **20**. Each frame key **68** is of sufficient dimensions to block the guide member **20** and to prevent movement of the guide member **20** along the base member **22** in the direction of the frame key **68**.

In the embodiment shown in FIGS. **3** and **4** the base member **22** is generally planar and rectangular in shape. The retentive longitudinal parallel positioning rails **30** upstanding from and substantially coextensive with the base member **22** are substantially inverted L-shaped in section. In the present embodiment, the base portion of the L is the distal end with respect to the base member **22**. Preferably the positioning rails **30** are respectively spaced apart from each lateral edge of a face of the base member **22**. Preferably, the base member **22** has apertures **92** therein for affixing the base to a supportive surface such as a horizontal surface by suitable fastening means such as bolt **94**. Advantageously, other fastening means such as at least one "C" clamp or a vise can be employed to securing the base member **22**.

Referring now to FIG. **7**, there is illustrated an embodiment of the housing **28** of the present invention in which the housing **28** is substantially a partially enclosed body shell for axially receiving in an annularly spaced-apart relationship the workpiece abrading head **16** in its enclosure. The housing **28** includes a close end face **46**, and a peripheral face **48** having an aperture **50** formed therein, and a lip **44** extending about an edge of the peripheral face **48** and defining an open end face of the housing **28**. The aperture **50** in peripheral face **48** exposes a portion of the workpiece abrading head **16**.

The housing **28** includes a base or mounting means **52** integrally formed with the bottom portion of the peripheral face **48** and adapted to allow the housing **28** to slidably nest in the base member **22** adjacent the second end **26** of the base member **22**. The housing **28** can be free standing and not permanently attached to any of the portable electric drill motor **12**, the shaft **18**, or the base member **22**. Preferably, however, the housing **28** is attached as by bolting to the base member **22** or is compressed against the face of base member **22** with a set screw extending through one of the positioning rails **30**. The exact dimensions of the housing **28** can vary with the magnitude of the workpiece abrading head enclosed therein. However, the housing **28** is of sufficient dimension that at least a portion of the workpiece abrading head is surrounded by, but spaced apart from, each of the closed end face **46**, and the peripheral face **48** of the housing **28**. In an embodiment in which the abrading head **16** is a sanding disc, the housing **28***a* can take the shape as shown in FIG. **11** in which the partial end face **46***a* facing away from the portable electric drill motor **12** is not closed but is cut away in part to permit access

to the face of the disc, and the workpiece support **54***a* is located on such end face **46***a*.

The housing **28** preferably includes a workpiece supporting surface **54** extending from the peripheral face **48** of housing **28** adjacent the aperture **50** in the peripheral face **48**. The workpiece supporting surface **54** allows a workpiece to be rested thereon while in contact with the workpiece abrading head **16** within the housing **28**. In a preferred embodiment, a removable clip **56**, such as that illustrated in FIG. **8**, slidably engages and is mounted on opposed edges of the workpiece supporting surface **54** and provides a supporting surface having a predetermined angle with respect to the workpiece supporting surface **54**. A number of removable clips **56**, each accurately shaped to a different predetermined angle can interchangeably engage the workpiece support surface to provide a variety of useful working angles.

In a preferred embodiment, the housing **28** also includes a liquid reservoir **58**. Liquid reservoir **58** is removably nested in the housing **28** such that the lower portion of the workpiece abrading head **16** is received by the liquid reservoir. In this configuration, with a suitable liquid, such as water or water thickened with a suitable gelling agent as understood in the wet honing art, e.g., polyvinyl pyrrolidone, in the liquid reservoir **58**, the apparatus of the present invention is especially suitable for use as a low speed wet honing device.

A variety of workpiece abrading means such as grinding wheels, honing wheels, belt sanders, disc sanders, wire brush wheels, buffing wheels, and the like can be used in the present apparatus. FIG. **6** illustrates a preferred embodiment wherein the workpiece abrading means is an abrading head **16** suited for either grinding or honing. In either operation, the head **16** resembles a horizontally disposed foreshortened cylinder-shaped abrasive disc or wheel containing in the center portion thereof, a foreshortened threaded axial shaft **60** which extends through the axial center of the head **16** which is compressively mounted on the shaft **60** by means of fastening element or nut **61** and washers **62**. The foreshortened shaft **60** extends through the entire workpiece abrading head **16**, and is sufficiently long to engage the tool shaft-receiving chuck **14** of the portable electric drill **12**.

Referring now to FIGS. **9** and **10**, there is illustrated another embodiment of the present invention in which the workpiece abrading means is a belt sander assembly **100** contained within an appropriate frame structure **76** which serves as at least a partial housing. The assembly **100** comprises a vertically upstanding frame member **76** having rotatably supported thereby and adjacent one end thereof an idler roll **78** for guiding and supporting thereon, in connection with a driven roll **82** an endless flexible sanding belt **80** having abrasive particles affixed to the exposed surface thereof. The drive roll **82** is supported by the shaft **18** mounted in the tool shaft-receiving chuck **14** of the portable electric drill motor **12** and is positioned adjacent the other end of frame member **76** just above the mounting plate **86**. The frame member **76** also carries a tension roll **84** mounted thereto and positioned between the idler roll **78** and the drive roll **82**. The frame member **76** is attached to the channel-like base member **22***a* by means of the mounting plate **86** being slidably engaged in longitudinal groove in each of the inwardly flanges of the channel-like base constituting base member **22***a*. The idler roll **78** may be attached to the frame member **76** by any suitable mounting means such as an inverted "*h*" shaped bracket journalled to receive the axial shaft of the roll. However, a supporting means such as a bolt **88** freely passing through the center of the idler roll **78** serving as an axle and being attached at both ends to the frame member **76** is preferable. Preferably the frame member **76** includes a workpiece supporting surface **90** which is supported by frame arm portion **96**.

As illustrated in FIG. **1** in one embodiment of the present apparatus, a battery-operated light assembly **72** having a bottom portion or base adapted to nest between or slidably engage the retentive side rails **30** of the base member **22** adjacent the housing **28** and disposed remotely from the guide member **20** is provided. As illustrated in FIG. **1**, the light assembly **72** includes an arm **74** which is preferably flexibly deformable to permit optimum positioning of the light.

In using the apparatus of the present invention, in the embodiment shown in FIG. **1**, a battery operated portable electric drill motor **12** is mounted, secured, and leveled on the guide member **20** with the handle grip up so that the tool shaft-receiving chuck **14** extends along a line substantially parallel to the plane of the guide member **20** and consequently also base member **22**. The guide member **20** is engaged in the base member **22** by sliding the outwardly extending flanges of support member **32** between the retentive parallel positioning rails **30** adjacent the first end **24** of the base member **22**. The housing **28**, surrounding at least a portion of the workpiece abrading head **16**, is engaged in the base member **22** by sliding the mounting means **52** securely between the retentive parallel positioning rails **30** adjacent the second end **26** of the base member **22**. The guide member **20** is advanced toward the housing **28** until the tool shaft-receiving chuck **14** of the portable electric drill motor **12** engages the foreshortened shaft **60** of the workpiece abrading head **16**. The tool-receiving chuck **14** is is then locked to securely hold the foreshortened shaft **60**. Frame key **68** is then placed in slots **70** and prevents the guide member **20** from advancing along the base member **22**. The portable electric motor **12** is turned on and the workpiece abrading head **16** is caused to rotate at a predetermined speed. The workpiece to be reduced in dimension is held on the workpiece support surface and manual pressure urges the workpiece into the abrasive surface of the abrading head **16**, until the desired amount of the workpiece has been reduced by the abrading head **16**.

When it is desired to hone the workpiece, the liquid reservoir **58** is inserted into the housing and filled with a quenching liquid such as water. When it is desired to sand the workpiece, belt sanding assembly **100** is engaged in the base member **22**. When it is desired to disc sand, the housing **28***a* can be used.

If desired, and oftentimes with great advantage, other attachments to, changes, modifications or inclusions in embodiments of the present invention can be provided and utilized without departing substantially from its apparent and intended spirit and scope. For this reason, it is to be fully understood that all of the foregoing is intended to be merely illustrative and is not to be construed or interpreted as being restrictive or otherwise limiting of the present invention, excepting as it is set forth and defined in the hereto-appended claims.

What is claimed is:

1. A portable apparatus for reducing the dimensions of a workpiece by abrading means comprising in combination:

a. a portable electric drill motor having a tool shaft-receiving chuck;
b. a rotatable workpiece abrading means operatively connected with a shaft adapted to be engaged by said chuck;
c. a guide member having supported thereon said drill motor;
d. a base member having a first end and a second end and adapted to receive and support (1) adjacent the first end thereof said guide member and (2) adjacent the second end thereof a housing adapted to generally surround at least a portion of said abrading means;
e. means for assuredly fixing each of said guide member and housing a predetermined distance along said base member;
said base member having retentive substantially parallel positioning rails extending longitudinally along each lateral edge of a face of said base member;
said guide member being slidable longitudinally of said base member between said retentive parallel positioning rails whereby the drill motor supported thereon is adjustably positionable with respect to the second end of said base member;
said housing being slidable longitudinally of said base member between said retentive parallel positioning rails; and
said base member being substantially coextensive with the combination of the guide member and the housing.

2. The apparatus of claim **1** wherein the guide member comprises:
a. a support member having generally an inverted "U" shape section with longitudinal edges terminating in outwardly extending flanges adapted to cooperatively engage the rails of said base member;
b. two spaced-apart U-shaped support brackets attached to said support member adjacent each end thereof, for holding in a cradle-like arrangement said drill motor;
c. compression means extending through each of said support brackets for selectively adjusting the spatial separation between upstanding arms of said support brackets; and
d. fastening means attached to said support member for securing said drill motor to said guide member.

3. The apparatus of claim **1** wherein the retentive rails of said base member are generally L-shaped in section with the base portion of the L being the distal end with respect to said base member.

4. The apparatus of claim **1** wherein the retentive positioning rails of said base member are inwardly extending flanges having longitudinal grooves formed therein.

5. The apparatus of claim **1** wherein the workpiece abrading means is mounted upon a foreshortened shaft.

6. The apparatus of claim **1** wherein the housing comprises:
a substantially enclosed body shell for axially receiving in an annularly spaced-apart relationship said workpiece abrading means, said body shell having an open end face, a closed end face and a peripheral face having an aperture formed therein for exposing a portion of said abrading means, said body shell having attached thereto mounting means for nesting said housing in said base member.

7. The apparatus of claim **6** including a workpiece supporting surface extending from said peripheral face of said housing adjacent the aperture in said peripheral face.

8. The apparatus of claim **7** including a clip removably mounted on opposed edges of said workpiece support surface for providing a workpiece supporting surface having a predetermined angle.

9. The apparatus of claim **6** wherein the workpiece abrading means is a honing wheel and the housing including a liquid reservoir adapted to be removably nested in said housing to receive a lower portion of said honing wheel.

10. The apparatus of claim **6** wherein the workpiece abrading means is a disc sander having an abrading face and a portion of the closed end face and a portion of the peripheral face of said housing partially cut away to permit access to the face of said disc sander.

11. The apparatus of claim **1** wherein the rotatable workpiece abrading means is selected from the group consisting of a grinding wheel, a honing wheel, a disc sander, a belt sander, a wire brush wheel and a buffing wheel.

12. The apparatus of claim **1** including indexing means spaced a predetermined distance along said positioning rails.

13. The apparatus of claim **12** including stopping means adapted to engage said indexing means for fixing said guide member a predetermined distance along said base member.

14. The apparatus of claim **1** wherein the drill motor is a battery operated motor.

15. The apparatus of claim **1** including a battery-operated light assembly having a bottom portion adapted to slidably engage the positioning rails of said base member adjacent said housing and disposed remotely from said guide member.

16. The apparatus of claim **1** wherein the housing comprises an assembly including a vertically upstanding frame member having rotatably supported thereon (1) adjacent one end thereof an idler roll for guiding and supporting thereon, in connection with a driven roll, adjacent the other end of said frame member a workpiece abrading means, said frame member including a tension roll positioned between said idler roll and said driven roll and mounting means for nesting said assembly in said base member.

17. The apparatus of claim **16** including a workpiece supporting surface extending from said frame member adjacent the mounting means.

18. The apparatus of claim **16** wherein the workpiece abrading means is a flexible belt having abrasive particles affixed to the exposed surface thereof.

19. An apparatus for mounting a portable electric drill motor and a housing therein in operative relationship which comprises:
a. a guide member adapted to support thereon said portable electric drill motor;
b. a base member having a first end and a second end and adapted to receive and support (1) adjacent the first end thereof said guide member and (2) adjacent the second end thereof said housing;
said base member having retentive substantially parallel positioning rails extending longitudinally along each lateral edge of a face of said base member;
said guide member and said housing each being slidable longitudinally of said parallel positioning rails;

said base member being substantially coextensive with the combination of said guide member and said housing and means for assuredly fixing each of said guide member and housing a predetermined distance along said parallel positioning rails.

20. A guide member for supporting thereon a portable electric drill motor comprising:

a. a support member having generally an inverted "U" shape section with longitudinal edges terminating in outwardly extending flanges adapted to engage a supporting base member;

b. two spaced-apart U-shaped support brackets attached to said support member adjacent each end thereof, for holding in a cradle-like arrangement said drill motor;

c. compression means extending through each of said support brackets for selectively adjusting the spatial separation between upstanding arms of said support brackets; and

d. fastening means attached to said support member for securing said drill motor to said guide member.

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